Middle-East Journal of Scientific Research 16 (2): 229-236, 2013
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2013.16.02.13216

The Roles of Government in the Commercialization of Technology Based Firms

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Abstract: The Commercialization of Technology Based Firms (TBFs) have been acknowledged to play an increasingly significant role in economic development and has been regarded as an engine of growth that gingers rapid industrialization, generates revenue, wealth creation and employment generation. Many universities and other research institutes in Malaysia have established Technology Transfer Offices (TTO) to support the scientist in the bid to commercialize Research and Development (R and D) initiatives. This among others are the lessons learnt from the Bayh Dole Act which shows that increasing policy support from various government has motivated academic entrepreneurs to chun out spin off companies. The purpose of this research is to find out the roles of government in the commercialization of TBFs in Malaysia. In this research, 28 technology based firms and 19 venture capital firms were interviewed with the aid of a tape recorder and some through observation. Data was later transcribed and analyzed through content analysis, identified items coded and emerging themes sorted. Conclusions are drawn from the study findings and recommendations made.

Key words: University and Research Institutes · Technology Entrepreneurs · Venture Capital · Spin Off Firms · Malaysia

INTRODUCTION

Background of the Study: Malaysian government has tried by providing full support to the Technology Based Firms covering many areas of the operations of the domestic government. The government agencies and their ministries make available certain support in technical expertise, training, disseminating information and financing. Other researchers also emphasized that small and medium-sized enterprises that are technology based are believed to be a key influence in the economic development, employment and creation of new innovations [1, 2]. In this view, TBFs are believed to face the challenge of how to access the technical and financial resources and commercialization capabilities necessary to bring their product to market [3, 4] also, one of the main constraints encountered by technology firms is their inability to get access to adequate financing. While arguing that technology based small firms play an important role in innovating, Rothwell [5] point out the challenges of access to finance, ability to cope with government regulations and non availability of adequate professional management expertise as a few of the challenges bedeviling technology small firms all over the world. The huge investment of capital channelled to public universities and research institutes by the Malaysian Ministry of Science, Technology and Innovations (MOSTI) and other agencies of government was aimed to achieve three main objectives; technology transfer through research and development, promotion of entrepreneurship and commercialization effort through the support of venture capital firms [5, 3, 7]. However, collaborations of partner agencies both public and private have a tendency to share mainly to the technology transfer matters and the resulting returns chances are the commercialization of research outputs. Additionally, the American government recognition of the significant role innovations play to the massive economic development of the nation led to the passage of Baydole Act which grant patent rights [8] to inventions arising out of

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government sponsored R and D to certain types of entities with the expressed purpose of encouraging the commercialization of new technologies through cooperative ventures between and among the research community, small business and industry [9, 10, 7]. Intellectual properties (IP) provide an economic incentive for companies to pursue further development and commercializatin and bring more new goods to market. Commercialization of new technologies within the new product development process helps firms streamline production, increase efficiency and revitalize the industry life cycle [1, 11, 12]. Successful technology commercialization helps emerging TBFs cross the chasm that appears during the life cycle of technological implementation and to solve problems induced by resource configuration difficulties associated with the transfer of sustained innovation to disruptive innovation [12-14]. The success of technology commercialization process is necessary to improve new product development performance by moving technological advances into commercial products, processes and services [15, 16]. This process includes the commercialization of internally generated technology within the company and technology procured from external sources such as other companies, federal laboratories and academic institutions. Lessons learnt from the Baydole act shows that increasing policy support from various governments has motivated academic entrepreneurs to chun out spin off companies [15, 17]. These initiatives were motivated by the intention to make best use of public fund spent on public research. The commercialization of results moreover provides a potential source of revenue for universities and other public research organizations, thus promising to reduce their dependency on public funds. This effort which resulted to the establishment of the Commercialization of Research and Development Fund (CRDF) in 1997 under the management of the Malaysian Technology Development Corporation (MTDC) to provide stimuli for the right innovation among Malaysian owned companies, by providing partial grants of up to 50-70% to qualified R and D projects in three types of activity areas.

MATERIALS AND METHODS

The researchers interviewed twenty eight technology entrepreneurs and nineteen venture capital firms in Kuala Lumpur and Johor Bahru. Out of the total sample

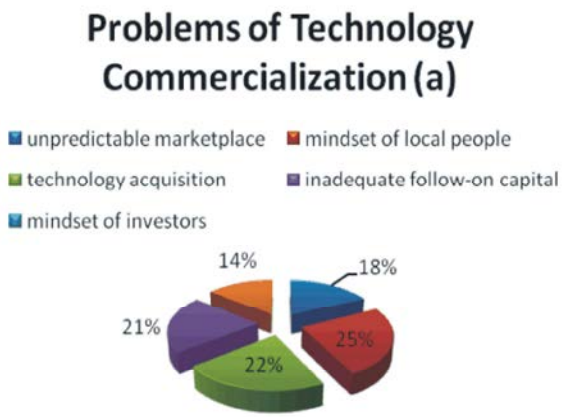

Fig. 1a: Pie Chart for Problems of Technology Commercialization (views of TBFs).

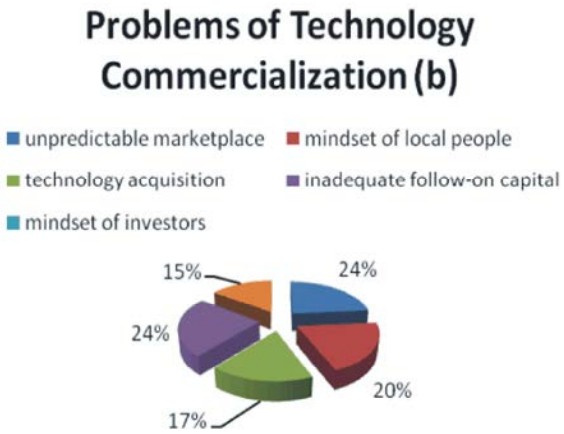

Fig. 1b: Pie Chart for Problems of Technology Commercialization (views of VCFs).

population interviewed for this study, 93% (44/47*100) of the respondents mentioned that the roles of government has been helpful in the commercialization of their technologies. Data was transcribed, coded and emerging themes presented in a table form, later converted to quantitative terms and used to plot the graphs in figure 1a and b for easy explanation of the study findings.

However, Mentioned Here Is the Specific Objective of this Study:

- To investigate the roles of government in supporting the commercialization of technology based firms.

Furthermore, in order to achieve this aforementioned objective, the following research question was posed and answered in this study;

- In what ways can the roles of government help to encourage the commercialization of technology based firms?

RESULTS AND DISCUSSIONS

This section includes key findings from the research conducted. It includes information about forty seven different Academic Entrepreneurs, Conventional Entrepreneurs and VCFs associated with different agencies of both government and private. Some of those companies were spin-offs from university research, while others were technology firms from outside the universities otherwise referred to as conventional entrepreneurs in this study. For the VCFs, among them are government supported VCFs, Private VCFs, Bank VCFs and Business Angels. This study is aimed at finding out the roles of government in the commercialization of TBFs in Malaysia. Although based on the authors findings, several roles government play to help the commercialization of technologies where reported, some of them are explained in this section.

Financing Research and Development in Malaysia: External funding provides the resources which enable universities to conduct Research and Development. This includes both government funding [16, 9] and industry funding through contract research or sponsored research [18]. Research in Malaysian universities is typically funded by a few agencies such as MOF, MOSTI and MOHE. The government provides money to the universities through funding agencies such as the Ministry of Higher Education (MOHE), Ministry of Finance (MOF) and Ministry of Science, Technology and Innovation and these agencies provide such funding in form of project grants through certain specialized research councils domiciled in the universities as Research Alliances (RA). With these efforts, many research universities in Malaysia are trying to engage in commercialization of Intellectual Property (IP). To encourage commercialization activities through the formation of spin-off companies, the government provides other types of financial support through Malaysia Technology Development Corporation (MTDC), Malaysian Venture Capital Board (MAVCAP), Multimedia Development Corporation (MDEC), Biotechnology Corporation (BIOCORP) and others. This supports are actually seed money to fund spin-off companies and to further develop their inventions up to the prototype stage. In Malaysia, the particular funding type and the sources will determine how the technology will be managed. For example, funding through university research grants will be managed through the technology transfer fund taking charge of the technology for exploitation and commercialization. But if the funding is sourced in collaboration with the industry, then there have to be an understanding on how the technology will be commercialized. Aziz *et al* reported that universities in Malaysia have been identified as among the key factors for the growth and rapid development of the nation [14]. This is reflected in the vast amount of investment of public funds into research activities among the universities by the government. This is actually a global trend that can be seen among both developed and developing countries across the globe. The investments made are in expectation of benefits that can be reaped by the researchers as well as enriching the growth of the country's economy. This is definitely true for Malaysia although, the trend had been that only small percentages of the R and D output by the universities in Malaysia do get commercialized. There are a number of funds, grants and incentives made available by the government to enable innovation and business creation among the universities. Reports show some examples of the government initiatives revealing that under the 9th Malaysia Plan (2006 - 2010), the Malaysian government invested a total of RM3.101 billion in the form of RandD grants. Meanwhile, under the 10th Malaysia Plan (2011-2015), the government allocated RM741 million for RandD among the universities for the first two years of the five year plan. The allocation was to be managed by the Ministry of Higher Education. In line with the new directives, the Ministry announced a set of R and D schemes to utilize the RM741 million allocations. Table 1 shows the technology support financing and areas of application in Malaysia.

The Commercialization of Technology Based Firms in Malaysia: In this study, technology commercialization can be defined as the whole processes involved in bringing up an innovation from the idea stage through concept formation, prototype development, pilot testing and eventual go to market stage of a particular product. This concept is by no means significantly important in studying the processes and having an understanding of the concept of commercialization of technology products

Table 1: Technology Support Financing and Area of Application in Malaysia [6]

Ministry	Department	Government Fund	Area of Application
Ministry of Science,	MOSTI	Science fund.	Research and pre-comm activities for all
Technology and Innovation	Biotech Corp.	Techno fund.	research clusters.
		Community innovation fund.	Research and pre-comm. activities for
		Seed fund.	biotechnology cluster.
	MIMOS	R and D fund.	Research and pre-comm activities for ICT
	MDEC	International Business Development Fund.	cluster.
	MTDC	Demonstrator Application Grant Scheme (DAGS).	Research and pre-comm activities for ICT
		MSC Malaysia R and D Grant Scheme (MGS).	clusters.
	MAVCAP	Commercialization of R and D Fund (CRDF).	All strategic and relevant technology.
		Technology Acquisition Fund (TAF).	All technology sectors.
		Venture capital fund	
Ministry of International	Malaysia External	Brand Promotion Grant (BPG).	Enhance branding and market exploration
Trade and Industry.	Trade Development	Market Development Fund (MDF).	capabilities of local products.
	(MATRADE).	High tech fund.	Provision of soft loans to the industries
Others	Malaysia Industrial	Factory relocation grant scheme.	(TBFs).
	Development Finance		
	(MIDF).		
	SME Bank (BPMM).	Short-term fund for automation and upgrading.	
	Central Bank Malaysia.	Short grant for ICT adoption.	
	Other commercial banks	Short grant for TBFs	

in Malaysia. The finding from this study is supported by researches of many past authors [11, 9, 16], who acknowledged that there are abundant difficulties encountered in the successful commercialization of TBF's product in general and the findings in Malaysia is not different from that of other countries. More so, several factors have been recognized to be responsible for these difficulties. But considering Malaysia as a case scenario, a whole lot of factors are involved and certain problems encountered during these processes that hinder the ability to commercialize more innovative products and help develop the economy industrially (Figure 1a and b). Malaysian government tries to help TBFs by providing certain amount of grant to fund the idea and help develop a prototype, from this, in order for the technopreneurs to commercialize and go to market, there is need to develop own alpha prototype stage to a beta prototype stage. There is a fund given by MOSTI called Techno Fund which allows technopreneurs to develop the alpha prototype stage to beta prototype stage and then proceed to do a pilot test which is a proof that the technology works, once that is done and the product is really good, then the technopreneurs can approach external equity investors. The volume of funds allocated to universities and other public research organizations in Malaysia served as an impetus that has resulted to many institutions of higher learning to encourage their scientist employees to make and disclose inventions, which can be patented and licensed to commercial firms and/or organize spin-off firms [20, 21]. As a result of the efforts of the technology based firms to get their products known to the domestic market, when the inventions are not ready to be fully commercialized, they engage with the help of certain government agencies for the mean time in test marketing and try to build traction. They do this in three different ways;

- They try and supply their first batch of production to the university, that is for university spin offs.
- They try to expand to other government agencies.
- Then try to move on to the outside world that is if the initial supplies are adjudged to be okay.
- Whereas the conventional technopreneurs build their traction on their own mostly from the domestic market because they support they receive from government agencies are limited.

In another view, the university TTO and other GVCFs often organizes exhibitions with the aim of coming out with technologies that are commercializable and through this events they help selected technology inventors to get external link for further funding. They do this in the following manner;

- They have a team that looks at technologies exhibited.
- They ask TBF managers/ inventors lots of questions about their products.
- They are asked to fill several forms concerning their innovation.
- At the end they select some products that they feel have some potentials.
- Later the selected TBFs are invited to attend some interview sessions to know if they have IP for their product or patent filling.

Considering this, a big picture of the roles government play through universities, research institutes and other technology promoting agencies emerges. These nurturing roles are significant because if TBFs are left to be on their own at that stage, they may not move forward because majority of them are pure academics and novice entrepreneurs and lack business cum entrepreneurial sense, even those who are not academics still lack the knowledge and skills to go it alone. The success of technology commercialization process is necessary to improve new product development performance by moving technological advances into commercial products, processes and services.

Problems Encountered During the Process of Technology Commercialization: The ability of an inventor to find a willing financier determines how quick his innovation can be commercialized. However, there are several challenges faced by technology inventors in commercializing their innovations. Previously, authors revealed that there is an existence of valley of death at the intermediate stage of the innovation sequence because funds are not available to finance the individuals and firms for taking a new innovation or discovery and transform it into commercial products [11, 22, 22]. Findings from this study reveal certain problems TBF managers go through during the process of trying to commercialize their technologies among which are;

- The unpredictable marketplaces as changes are unavoidable.
- Technology advancement.
- Political and economic instability.
- Social and consumer awareness.
- Skeptical perception of local products.
- Problem lies in finding the right investments.
- Insufficiency of experienced professionals in the VC industry.

The problems reported above play a part in helping or hindering the commercialization process. However, the key is to be able to adapt and move with the changes. To commercialize, Malaysians need more knowledge on the need to continue to carry out more R and D to strengthen their technologies by understanding more about the competitions, satisfaction level of customers, sustaining product quality level, groom young people with broadminded initiatives. Furthermore, there is need to groom more VC professionals who will help in proper evaluation of technologies to be funded. Figure 1a (views of TBFs) and b (views of VCFs) represent some of the problems technology based firms go through in the process of commercialization of their technologies. However, as presented in the figure below, the researcher found that the views of TBFs interviewed are virtually the same when issues pertaining to the commercialization of TBFs were raised. From the experience of the TBFs. However, among 28 TBFs interviewed, 21% mentioned unpredictable market place as among the challenges they have to go through in commercializing their technology while 14% mentioned technology acquisition, 18% mentioned mindset of the financial investors, 25% mentioned mindset of the local people and 22% mentioned inadequate follow on capital. For the 19 VCFs interviewed, 24% of the respondents mentioned that unpredictable market place is a big huddle for TBFs to surmount since both the investors and the TBFs could not foresee what the market holds in stock for them in terms of competition, political issues and others, 19% said that acquiring technology from overseas is also tasking, 24% believe that the mindset of the financial investors are important in how much they want to invest in TBFs, 20% of the participants mentioned mindset of local people affect their ability to commercialize since they believe more in foreign products and finally 17% mentioned that inadequate capital to grow their TBF to the next level is among the daunting task that determie TBFs commercialization in Malaysia.

Government Encouragement of the Commercialization of TBFs: There cannot be any comparative study on innovation commercialization without looking at the U.S.A, a country that is widely acknowledged by several authors as the industry's birthplace. The US government's efforts to bridge the equity start-up financing gap can be traced back to the 1940's, when such a gap was first identified and have undergone two stages. However, it is no more news that Malaysian government have been globally acknowledged as among the top countries that have channelled substantial amount of

capital into SME financing and several non financial supports are bound towards helping to commercialize many TBFs. But, despite the huge financial and non financial support from the government, interest parties still think there is need to do more in terms of building the right eco-system for young companies to thrive and for more investors to funnel their capital into growing the technology sector rather than more of property financing which they perceive as less risky and more profitable. Furthermore, stakeholders in the technology financing sector have opined that for Malaysia as a country to join the league of newly industrialized nations in Asia, there is need to strengthen some structures that have already being put in place and make them work better. Though, there is an acknowledgement that the government is already offering assistance to help start-ups from funding to advisory. However, the technopreneurs are expected to step up and do more for their selves and be less reliant on government. In addition to providing grants, Cradle, MAVCAP, MDEC, MLSCF, MTDC and others offer commercialization support such as business advisory, mentorship and training to recipients so as to enable them become sustainable technopreneurs. Although, many stakeholders are quick to argue that if government expect products to come out of the universities;

- There is need to provide more funding for universities to do research.
- Provide more facilities to university laboratories.
- Employ more research manpower to help in the laboratories.
- Encourage University-Industry collaboration through incentives and proper monitoring.
- Although, this is risky, government should funnel most of the funds directly to the university and not expect profit at the early stage since not all research results can be commercialized.

Specific Roles of Government in Commercialization: In many instances, financial managers (VCFs, Banks and Financial Institutions) require government guarantee as a means of securing long term capital provided to finance TBFs at their early stage. This is because they are investing funds that belong to various individuals and shareholders to whom proper accountability must be provided, many a times, though government policy such as tax requirements, legal requirements, capital market regulatory frameworks and beaurocratic tendencies are believed to discourage fund managers from investing in this sector. The government is trying to look at ways of making these huddles less cumbersome to investors in technology sectors as a source of encouragement. However, in addition to expanding the number of government supported VCFs, Malaysian government is presently considering more in the following ways; provide more friendly import duty, tax rebates, subsidies and sales tax exemption on machinery and equipments purchased by technology new ventures for their operation, provide grants to be used by banks to support technology ventures and provision of guarantor responsibility to early-stage tech firms, grant PR status to and encourage genuine foreign immigrants with innovative ideas (as in the case of Singapore and USA), among others. So, that is where it is hoped that government will come up with innovative products, government is trying to look at tax incentives which will motivate VCFs to finance ICT businesses. This study reported that similar zeal as such related to that of the America's government has been adopted in Malaysia as an impetus to grow the national economy through innovation commercialization. More so, that government have acknowledge the difficulty entrepreneurial firms face in raising growth capital is a very good development, which is a reflection of many efforts and programs they support through a wide array of public agencies saddled with the responsibilities to create awareness about financing technology businesses because they have been recognized as the spring board for national industrialization of any nation.

CONCLUSIONS

This paper looks at the leading question the researcher seek to study in this investigative work which is aimed at finding out the roles of government in the commercialization of Technology Based Firms. This research firstly highlights the background of the problem which then leads to the problem statement, research question and the objective of the study in order to understand the area of study. However, authors finds that this area of research have not really been exhaustively investigated in Malaysia and the researcher beliefs practitioners are seeking for a lot of recommendations in this regards because academic publications are little. Although, several other researches recognized the roles of government in commercialization in developed countries but for the developing countries like Malaysia this has not been properly articulated and presented in academic databases. Hence, this research tries to begin to fill that craving gap of knowledge. The results from the analysis of findings provided answers to earlier question put forward at the

commencement of this study. The nature of research on commercialization as an area of study is such in a manner that findings provided shall add abundant value through their applicability in an organizational setting and adoption by public policy makers in Malaysia. The themes that have emerged from this study can help interested parties and stakeholders to better understand the roles of government in the commercialization of technology based firms to be successful and global companies. This study also prescribes some recommendations for improving the chances of commercialization of more technology new ventures in the country. In view of the aforementioned findings, the objective set out at the commencement of this study has been achieved.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the International Doctoral Fellowship (IDF) of the Universiti Teknologi Malaysia (UTM) for part funding this study.

REFERENCES

1. Massa, S. and S. Testa, 2008. Innovation and SMEs: Misaligned Perspectives and Goals among Entrepreneurs Academics and Policy Makers. Technovation, 28(7): 393-407.
2. Granovetter, M., 2005. The Impact of Social Structure on Economic Outcomes. Journal of Economic Perspectives, 19(1): 33-50.
3. Lin, C., L.J. Jiang, J.Y. Wu and C.C. Chang, 2011. Assessment of Commercialization Strategy using R and D Capability. Industrial Management and Data Systems, 111(3): 341-369.
4. Baerz, A.M., *et al*. 2010. Exploring of the Role and Position of Institutional Actors in the University-industry Interactions. World Applied Sciences J., 11(11): 1432-1438.
5. Rothwell, R. and W. Zegveld, 1982. Innovation and the Small and Medium Sized Firm" London: Printer Publisher.
6. MOSTI, 2012. Industrial Technology Development: A National Plan of Action. Kuala Lumpur, Malaysia; Ministry of Science, Technology and Innovation (www.mosti.gov.my).
7. Yaakub, N.I., M. Hirwani, M. Abdul Rahman, Z.A. Zainol, K. Mujani, E.A. Jamsari, A. Sulaiman and K. Jusoff, 2011. Challenges for Commercialization of University Research for Agricultural Based Invention. World Applied Sciences Journal, 12(2): 132-138.
8. Kim, Y.J. and G. Clarke, 2013. Determinants of Inter-Firm Technology Licensing in the EU. Applied Economics, 45(5): 651-661.
9. Ismail, K., S.A. Aslan and M.A. Ajagbe, 2011. A Conceptualized Approach towards Building a Growth Model for Venture Capitalists Finance of TBFs. International Journal of Innovation, Management and Technology, 2(4): 315-320.
10. Kim, J., 2012. Study of the Performance and Characteristics of U.S. Academic Research Institution Technology Commercialization (ARITC), Portland State University.
11. Zeng, S.X., M.C. Tam, L.K.T. Tong and M.P. Sun, 2010. Creating Synergy for Cross-Cultural Teams in International RandD Projects. African Journal of Business Management, 4(13): 2625-2633.
12. Bodunkova, G.A. and I.P. Chernaya, 2012. Fractal Organization as Innovative Model for Entrepreneurial University Development. World Applied Sciences Journal, 18: 74-82.
13. Li, Y., H. Guo, Y. Liu and M. Li, 2008. Incentive Mechanisms, Entrepreneurial Orientation and Technology Commercialization: Evidence from China's Transitional Economy. Journal of Product Innovation and Management, 25: 63-78.
14. Jaafar, M., A. Maideen and Z. Mohd Sukarno, 2010. Entrepreneurial Characteristics of Small and Medium Hotel Owner-Managers. World Applied Sciences Journal, 10: 54-62.
15. Wonglimpiyarat, J., 2010. Commercialization Strategies of Technology: Lessons from Silicon Valley. Journal of Technology Transfer, 35(2): 225-236.
16. Ajagbe, A.M., K. Ismail, K, S.A. Aslan and W.N. Rashid, 2012. Technology Based Firms Financing: An Operational Model for Malaysia. South East Asia Journal of Contemporary Business, Economics and Law, 1: 108-114.
17. Mousavi Tatfi, S.A., 2011. The Factors Hindering Innovation at Iranian Smes World Applied Sciences Journal, 14(11): 1635-1641.
18. Greenstein, S., 2010. Open Platform Development and the Commercial Internet Platforms. Markets and Innovation, pp: 219-248.
19. Aziz, K., H. Harris and H. Norhashim, 2011. University Research, Development and Commercialization Management. A Malaysian Best Practice Case Study. World Review of Business Research, 1(2): 179-192.

20. Lichtenthaler, U. and M. Muethel, 2012. The Role of Deliberate and Experiential Learning in Developing Capabilities: Insights from Technology Licensing. Journal of Engineering and Technology Management, 29: 187-209.
21. Janssen, M. and E.H.M. Moors, 2013. Caring for Healthcare Entrepreneurs-Towards Successful Entrepreneurial Strategies for Sustainable Healthcare. Technological Forecasting and Social Change, 5(2): 20-29.
22. George, F.S., K. Thomas and A.J.S. Lawrence, 2007. Valley of Death in the Innovation Sequence: An Economic Investigation. Phoenix Center for Advanced Legal and Economic Public Policy Studies, pp: 278-311.
23. Anokhin, S., J. Wincent and J. Frishammar, 2011. A Conceptual Framework for Misfit Technology Commercialization. Technology Forecasting and Social Change, 78: 1060-1071.